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With the Compliments of the Authors.

The Appendix Vermiformis, its
Function, Pathology and
Treatment.

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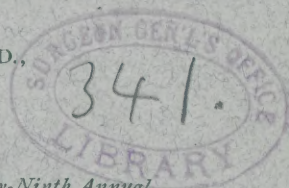
The Diagnosis of Pericæcal Ab-
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Removal of the Appen-
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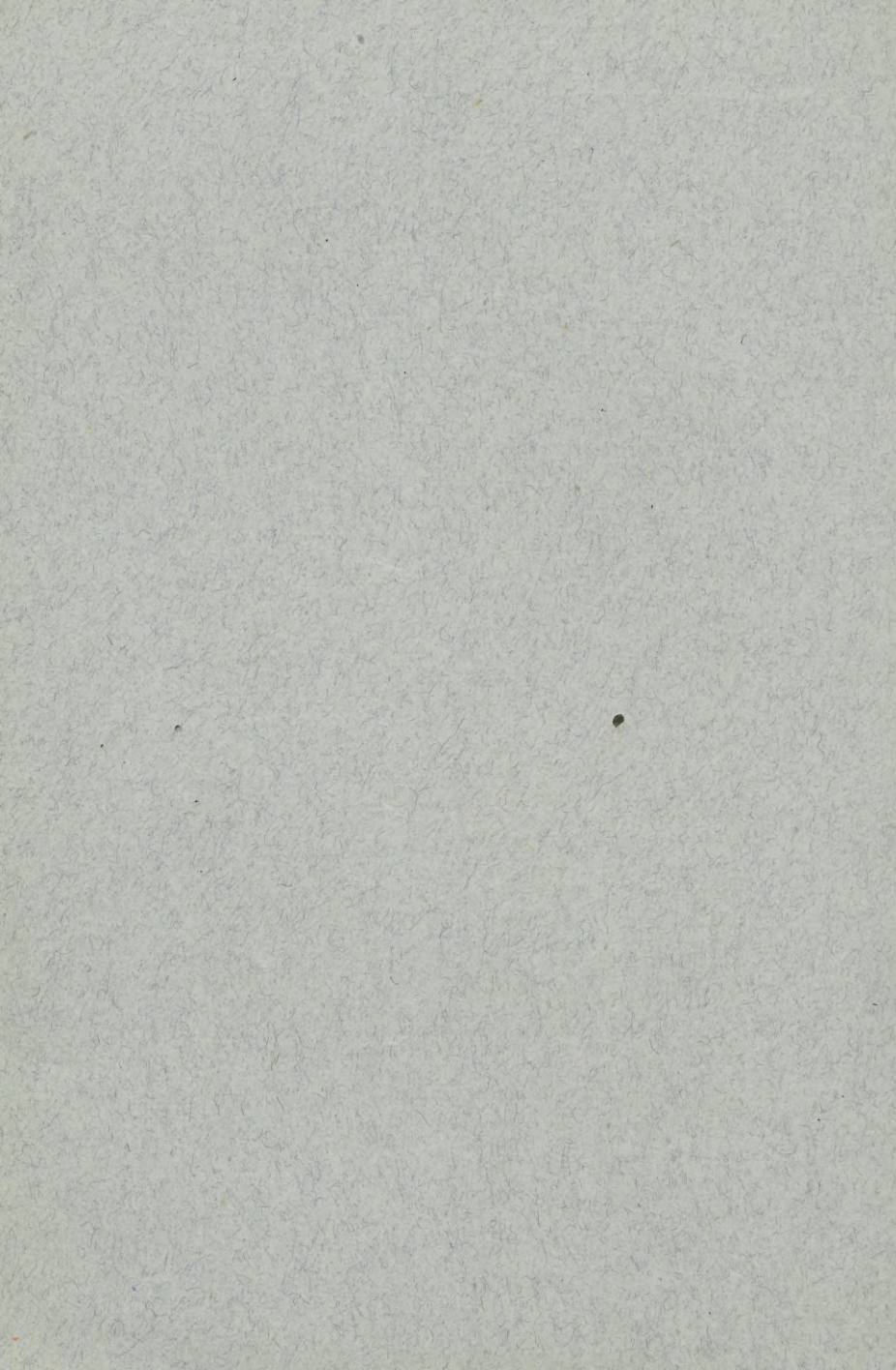
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THE APPENDIX VERMIFORMIS, ITS FUNCTION, PATHOLOGY AND TREATMENT.

In writing of "Intestinal Obstructions," Mr. Treves states,¹ that "their importance may, in one way, be estimated by the circumstance that over 2,000 individuals die every year in Great Britain from obstructions of the bowels, exclusive of hernia." Dr. Senn, of Milwaukee, also considers them of such consequence, that during the last eighteen months (January 1888) he has reported² "one hundred and fifty operations performed on animals, for the purpose of studying the effects of the principal varieties of intestinal obstructions produced artificially." Treves does not state what proportion of the deaths he speaks of, were due to disorders of the appendix, and Dr. Senn's experiments have not yet been extended to this tube. It is, however, widely known, that the appendix is sometimes a cause of constriction of the ileum, and that stenosis of its cæcal orifice, from inflammation of its coats, or concretions or foreign bodies in its canal, frequently induces local and general peritonitis, peri-cæcal abscess or perityphlitis. Whether the starting point of the latter is in the appendix or the cæcum, is a question yet *sub judice*; but there is much evidence daily accumulating to show that it is the appendix. In the United States, Dr. J. H. Musser, of Philadelphia, states,³ "that appendicitis is in the *origin* of peri-cæ-

¹ Intestinal Obstructions, its varieties, with their Pathology and Treatment, by Frederick Treves, F.R.C.S., London, Phila. Edition, Preface. 1884.

² An Experimental Contribution to Intestinal Surgery, with special reference to the Treatment of Intestinal Obstructions. By Nicholas Senn, M.D., Milwaukee, Wis.

³ The Morbid Anatomy of Peri-cæcal Inflammation, by J. H. Musser, M.D., Phila., Journal American Medical Association, page 71, Jan. 21, 1888.



cal abscess, perityphlitis, and peritonitis in about 90 per cent., or perhaps a larger proportion, of such cases," and it is now, I think, generally admitted by surgeons, that perforations of the cæcum are rare as compared with those of the appendix.

In the *Index Medicus*,⁴ are references by 248 authors to disorders of the appendix, as the result of the appendicitis. Of these cases, ninety-four only are reported as due to the presence of foreign bodies. Some of these authors detail several cases: Lewis, of New York, furnishing forty cases of foreign bodies alone. As seventy-six of these authors were physicians of the United States, the results of appendicitis have been widely recognized, though not so assigned by them. Concretions and supposed foreign bodies, were found in about 30 per cent. of these cases.

Although so well and widely known, Lieberkühn having written "*De valvula cæci et usu processus Vermicularis*" in 1739, and Herlin "*De l'usage de l'Appendice Vermiformis*," in 1718, this organ has not been as minutely studied in its relations to the alimentary canal and the process of digestion, as the fatal character of its disorders demands, and though all present, doubtless recall the general anatomical relations of the appendix, perhaps its special structure and its probable function are not so well understood. Indeed, there is reason to think that many practitioners hold the opinion of a recent writer and teacher who states,⁴ "we have this little organ (appendix) singularly useless physiologically, placed in a singularly unfavorable position anatomically, and so formed that escape of its contents is very difficult, whilst it is very prone to become diseased."

A few words on the special anatomy of the appendix, may suffice to bring the subject of ap-

⁴The Diagnosis of Peri-cæcal Inflammation, by Wm. Pepper, M.D., LL.D., Phila., Journal American Medical Association, page 72, Jan. 21, 1888.

pendicitis and its results, to the notice of this Section, and elicit such discussions as will tend to show the surgical opinions on the subject, and aid in the scientific treatment of a serious pathological condition that is daily creating increased interest: Pericæcal abscess and perityphlitis being often only symptoms of a pre-existing disordered action in the appendix.

SPECIAL ANATOMY OF THE APPENDIX.

The appendix cæci, or vermiformis, in man, varies in length from six or eight to ten centimetres; or from two to six or nine inches,⁵ the cæcum being only one and one-half to two inches long, and widely expanded. The calibre of the appendix, is in breadth internally, about the size of a goose-quill. It is *not* a straight tube, but is generally slightly flexed or curved on itself, and varies in its normal position and direction, being sometimes adherent to the left and posterior face of the cæcum and extending upwards nearly to the gall-bladder, or under surface of the liver.

Its blind extremity points nearly always towards the spleen, though it may dip down into the pelvis and become adherent to the right broad ligament of the uterus or to the right ovary, these variations of position being due to the length of the fold of its peritoneal attachment to the mesentery. Sometimes its free end becomes adherent to some other organ, and is twisted as a loop around the small intestine as a constricting band, causing obstruction or strangulation of the involved bowel. At its base, the appendix opens obliquely into the posterior and inner side—but not the lowest point of the cæcum—just below and on the same side as the ileo-colic valve, whilst its summit or blind end, is rounded and firmly closed. On slitting open the canal of the appendix, we may note the comparative thickness of its walls,

⁵ Reported nine inches by Dr. T. G. Morton, Philadelphia.

and that its mucous coat and sub-mucous tissue, is well developed, and by a semi-lunar fold that partly conceals the caecal orifice, forms a sort of valve or ridge, that opposes the passage of solids from the cæcum to the appendix, fæces, etc., being forced into the appendix mainly by straining or by vomiting.

Speaking of this valve of the appendix Henle says⁶ "that as a rule, this duplicature of the mucous membrane is sometimes only a small border or projection, but at other times it occupies half or more of the calibre of the opening, and interferes with a free communication between the cæcum and the appendix in either direction. Sometimes opposite to this valve and deeper in the appendix, there is a second valve-like projection." Gerlach states⁷ "that in elderly people, these valves of the appendix are atrophied or shrunken, and this is the reason why perforation from the pressure of concretions (Kothsteines or excrement stones) is unknown," and this confirms the opinion that perityphilitis is comparatively rare after 40 years of age. Bauer says,⁸ "Typhlitis is most common between 16 and 35." Appendicitis is mostly met with before the 45th year, though sometimes, as in a recent case in New York, the patient was 58 years of age and had sloughing of the appendix, from a concretion, abscess and general peritonitis.

The coats of the appendix are the same as those of the other intestines, but its walls are often much thicker, and vary in thickness according to the contraction or diminution of the length of the tube. In its muscular coat, the longitudinal fibres predominate over the circular ones, and are apparently a continuation of some of the fibres of one of the longitudinal bands of the colon. The action of these longitudinal

⁶ Handbuch der Systematischen Anatomie des Menschen. Von Dr. J. Henle, page 178. Eingeweiderlehre, 1862.

⁷ Gerlach: Abhandl. der Erlangen Physical. Medicin. Societät. 11, 7.

⁸ Ziemssen's Cyclopedia of Med. Vol. viii.

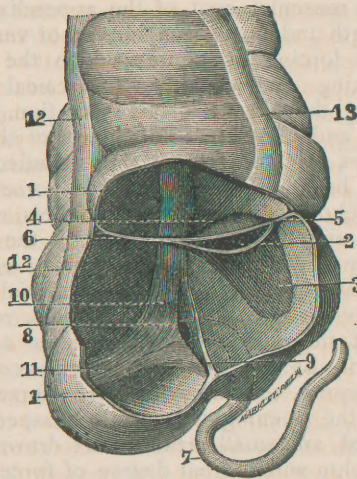


FIG. I.—Circular Section of the anterior and external portion of the cæcum, showing the appendix vermiformis and the ileo-cæcal valve.

1. Distended dried cæcum at its lowest point and below the opening of the appendix and ileo-cæcal valve.
2. Orifice of the ileo-cæcal valve.
3. Its inferior duplicature.
4. Its superior fold, as seen on the front.
5. The anterior and internal edge or bridle of the valve.
6. Its longer and posterior bridle.
7. The appendix vermiformis as often found, curved and pointing to the spleen.
8. Its round or trumpet-shaped mouth.
9. The semilunar fold of its mucous coat, which partly closes the orifice of the valve of the appendix. The course of the appendix towards the opening in the cæcum is indicated by dotted lines.
10. The longitudinal muscular fibres of the posterior external band of the colon, which are continued under the valve and constitute the longitudinal fibres of the muscular coat of the appendix, and cause its curved shape when contracted. These fibres force the contents of the appendix into the cæcum.
11. The anterior longitudinal band of the colon.
12. Its prolongation on the ascending colon.
13. The posterior longitudinal band of the colon. It will be noticed that there is a pouch of the cæcum below the level of the orifice of the appendix, so that nothing can drop into the appendix.

Copied from Prof. Sappey's Anatomy, Paris, 1874.

fibres of the muscular coat of the appendix, diminishes its length and gives it a curved or vermicular action, thus forcing its contents into the cæcum whilst relaxing and opening the cæcal orifice, and favoring the escape of its secretion. (Dried Specimens) and (Fig. 1.) The power of the longitudinal fibres of the colon thus alluded to is marked, as has been shown in the horse at the veterinary school of Alfort, where bullets, marbles, and other foreign bodies swallowed by the animal, were quickly elevated in the ascending colon by muscular contraction. In a case of artificial anus in the Pennsylvania Hospital, Philadelphia, reported⁹ by Dr. Hunt, the vermicular movement of a portion of the posterior band of the colon which is continued into the appendix, was so strong, that a finger introduced into the opening was firmly grasped by the muscular coat, and small articles were drawn up the ascending colon with a great degree of force.

"The follicles of Lieberkühn" or the tubal glands, are numerous, and found in the mucous coat of the appendix. The "agminated glands of Peyer" are also well developed near the summit of the tube. It is not settled that a gland or two of "Brunner" is not also present. In the Herbivora and omnivorous animals, these glands of Peyer are more developed than in the Carnivora. Prof. Colin of Alfort, regards them as secretory organs, and of enormous dimensions in the Rodents. He says¹⁰ "A gland of Peyer of the length of a finger of a glove, lines their appendix throughout its entire length. Sometimes he also found the appendix free from food and entirely full of a beautiful greyish opaque or transparent liquid, analogous to a solution of gum, and this liquid was not found in other portions of the small intestines, but was sometimes found in the colon when the

⁹ Reports of the Pennsylvania Hospital, Vol. 1, page 164, Philadelphia, 1868.

¹⁰ Colin, *Physiologie Comparée des Animaux*. Paris, 1886, page 91.

solitary follicles were very closely developed. This fluid is similar to the mucous found in the appendix of man. When stenosis of the canal of the appendix occurs, and the escape of its secretion is prevented, the appendix may become distended to the size of the fore-finger or larger, creating a "Mucocoele" a case of which is reported¹¹ by Feré. In the new born infant the canal of the appendix is relatively larger than in the adult, and often contains Meconium whilst in the adult, small hard particles of solid faeces resembling the dung of mice, or like raspberry seeds, may become the nucleus of concretions that frequently are mistaken for foreign bodies that have been swallowed. In the post-mortem examinations of bodies, accidentally in the dead house of the Pennsylvania Hospital, concretions were found in each as shown in the specimens.*

FUNCTION OF THE APPENDIX.—Whilst the structure of the appendix has thus been studied, its *Function* yet remains in doubt. Indeed, several writers regard the function of this organ as of but little importance, an appendix vermiformis being present only in six varieties of animals. Dr. Chap-

¹¹ Progrès Médical. Paris, 1877, 1 page 53.

*(NOTE.—Some notes on the vermiform appendix. Received April 30, 1888, from Dr. Henry F. Formad, Demonstrator of Morbid Anatomy in the University of Pennsylvania, and as Coroner's physician, largely occupied on post-mortem examination.)

DR. HENRY H. SMITH, Philadelphia.

Dear Doctor.—From my notes upon cases and studies upon the post-mortem table, I found that you are perfectly correct in your observation that the vermiform appendix is proportionally much larger in infancy than in adult life. Microscopic examination also confirms your observations on the vermiform appendix, with all the glandular elements peculiar to the small intestine, save the Brunner's glands, and that it evidently contributes to the functions of digestion. I have very frequently seen typhoid and tubercular ulcerations, and catarrhal changes, in the vermiform appendix, as a part of a general disease of the mucous membranes of either the large or small intestines. The average length, is from three to seven inches—the length being greater in the colored race, and relatively greater in the Germans and Irish than in other nationalities. Fæcal matter and concretions are exceedingly common in the vermiform appendix, surely much more common than is generally held.

Yours respectfully,

HENRY F. FORMAD.

man, of Philadelphia, says: (a) "That a true appendix vermiformis is only found in Man, the Gorilla (b), Gibbon (c), the Chimpanzee, the Orang (d), Wombat (e), and Capybara (f), and that in many of the mammalia, the cæcum (which corresponds to the cæcum and appendix together in man) is large and often very long; that in the mammalia generally, the size of the cæcum is in an inverse ratio to that of the stomach. In the Capybara or Water-Pig, whilst its cæcum measures twenty-six inches its stomach measures ten inches; whereas, in man, whilst the stomach measures latterally from thirteen to fifteen inches, his cæcum is only from one and one-half to two inches, and his appendix vermiformis measures from three to six inches. Chapman, therefore, regards the appendix in man as having no particular significance or utility."

Morgani, Jno. Hunter, Meckel, Haller, and others, also report authentic cases in men, where the appendix was wanting, and hence, they ascribe little value to its function. Nevertheless, as it exists in connection with the alimentary canal, and as its disordered action disturbs digestion to a degree that often results in death, it may influence our treatment of its diseased condition, to recognize, if only on imperfect proof, its healthy connection with the process of digestion as seen in animals as well as man.

In studying digestion in man, we note that as the chyle passes from the ileum through the ileo-colic valve, it rests or settles into the lowest portion of the cæcum as a liquid substance, on which the secretion of the appendix is poured out. As the liquid elements of the chyle are rapidly absorbed, a thickened

(a) Transactions Philadelphia Coll. of Physicians. Vol. 9, 3rd. Ser. Page 192. 1887.

(b) Gorilla. Eats fruits, seeds and the young shoots of plants.

(c) Gibbon. Anthropomorphous Monkey is omnivorous, but prefers fruits and roots.

(d) Orang. Eats meats, but prefers fruit.

(e) Wombat. (Phascolomes) lives on vegetables.

(f) Capybara. Feeds on grasses.

mass is seen to form and undergo chemical changes, being transformed from an acid to an alkaline substance with the evolution of hydrogen, nitrogen and other gasses that create a marked fæcal odor, not ordinarily so marked in the small intestines. The absorbent action of the cæcum is accomplished through its mucous coat, which is furnished with numerous follicles or "cryptæ minimæ," of Meckel. The great uniformity of these follicles in the colon, Horner states,¹³ "enable us to count them with certainty thro' the microscope. In the cæcum, they are found at the rate of about 400 for every one-eighth of an inch square, and admitting the entire area of the colon to be 500 inches, and that 19,200 of these follicles exist in every square inch, we have the extraordinary number of 9,620,000 muciparous crypts or absorbing points, in connection with the underlying veins and arteries of the large intestines. That the cæcum alone creates marked changes in the chyle by the absorption of its liquid elements through the blood-vessels and crypts just alluded to, is well known. It is not therefore surprising that this very vascular structure of the cæcum should soon participate in the inflammatory changes induced by disordered action of the appendix which open into it."

That the appendix exercises some influence on the action of the cæcum in digestion is quite probable, as its mucous coat differs very materially from that of the cæcum and colon in the arrangement of its capillaries and mucous crypts, as shown¹³ by the minute injections of Neill, of Philadelphia, in 1851; whilst Gerlach states:¹⁴ "that the intervening spaces between the crypts of the appendix are so prominent, as to make them look like small bridges" a marked

¹³ Special Anatomy, by Wm. E. Horner, M.D., Philadelphia. Vol. ii, page 57.

¹³ On the Structure of the Mucous Membrane of the Appendix Vermiformis, Cæcum and Colon, by John Neill, of Philadelphia. Medical Examiner, Vol. vii, N. S., page 85, 1851.

¹⁴ Gerlach. Abhandler Erlangen.

anatomical difference. With this vascular structure, we may well suppose that the secretion of the appendix is free, and differs in some way from that of the cæcum. Perhaps it is the source of a lacto-peptone mixed with a large amount of mucus and some phosphates or carbonates of lime, that in some way modifies the formation of the fæces, and by its mucus secretion facilitates their passage up the ascending colon; hence, an early symptom of appendicitis is constipation. The presence of an appendix vermiformis in certain herbivorous animals and its absence in the carnivora, would also seem to indicate that this organ has some influence on the digestion of vegetable matter. Tiedman and Gmellin, long since observed that the gastric juice of the herbivora, possessed this power, whilst that of the carnivora, (that have no appendix) was not sufficiently active to destroy coarse vegetables, cereals or hay or straw.

The term "gastric juice" thus employed by them, is not limited to the secretion of the glands of the stomach, but includes the secretion of the liver, pancreas, and intestinal juices. In the Carnivora that have no appendix, the pancreas is said¹⁵ to be comparatively small, and though participating in digestion, it is well known that both they and the appendix vermiformis can be excised without materially impeding digestion; thus Brunner¹⁶ in 1673, removed the pancreas from eight dogs that continued to live varying periods; their fæces remaining normal; and Prof. Colin,¹⁷ of Alfort, in 1857, removed portions of the pancreas in six dogs, the animals subsequently preserving their health and spirits and increasing in flesh.

Whatever may be the part played by the appendix vermiformis in connection with digestion (and its

¹⁵ Dictionnaire de Médecine. Tome x. Paris, 1835, page 348.

¹⁶ Physiologie Comparée des Animaux. Par Colin d'Alfort. Prof. Ecole Vétérinaire. Paris, 1886, page 882.

¹⁷ Opus Citat.

function certainly requires further investigation), it is evident that we have in it a mucous coat liable to catarrhal inflammation, under which changes are created that lead to stenosis of the tube, to the accumulation of its secretion, to distention, ulceration, and perforation of its coats, and to peritonitis, that is soon followed by pus, and abscess in the right iliac region, especially in the loose connective tissue around the cæcum, a symptom often spoken of as *perityphlitis*. This catarrhal inflammation or appendicitis, resembles in its results duodenitis with obstruction of the ductus, communis choledicus, or of the ductus ad nasum with obstruction of the course of the tears from the saccus lachrymalis.

As surgeons, are we not then justified in supposing that the function of the appendix is to aid digestion and the onward course of the fæces from the cæcum, and consequently, must we not in the early stages of appendicitis, carry out the same treatment as would be proper in any catarrh of a mucous membrane? In other words, should we not strive to overcome the early constipation and restoration of the natural secretions of the bowels by emptying the cæcum, and favoring increased peristaltic action? Or, when this fails, promptly overcome the obstruction by an operation?

PATHOLOGICAL CHANGES IN THE APPENDIX VERMIFORMIS.

The varying position of the appendix has been noted by Treves, of London, Fitz, of Boston, Formad, of Philadelphia, and several others. Its most usual position is behind the ileum and its mesentery with the tip pointing to the left, or behind it on the inner or left side of the cæcum, pointing directly upwards and often adherent to the colon. It may be found in a right inguinal hernia.¹⁸ It may vary in size as well as position, being sometimes small and

¹⁸ Pathological Society. London, vol. xxv, 1874.

atrophied, or dilated to the size of a finger or of the ileum,¹⁹ dilatation being more common than atrophy. It usually contains mucus or specks of hardened fæces, but not unfrequently presents concretions or calculi that are adherent to and distend the tube. These calculi (or supposed foreign bodies that are swallowed,) according to an analysis recently made at my request,²⁰ were composed of calcium and phosphoric acid ($\text{Ca}_3(\text{PO}_4)_2 = \text{Ca}_2\text{H}_2(\text{PO}_4)_3 = \text{CaH}(\text{PO}_4)_2$), and did not contain any cholesterin. Another small specimen, (*b*) weighing only 80 milligrams, left about 6 per cent. of ash, consisting of calcium phosphate with a small amount of carbonate of lime. Its structure was laminated. The examination of a second and larger specimen by Dr. Leffman gave the same results, phosphate of lime and no cholesterin. Inspecting a section under the microscope, I found a conglomerate structure of yellowish-brown atoms, united by apparently condensed mucus. Another specimen, at first supposed to be a cherry stone, was examined microscopically by Dr. Guy Hinsdale, of Philadelphia, and proved to be only impacted fæces. It gave a reaction for magnesium, which the others did not.

Blood, fæces, seeds and substances swallowed, as shot and pins, and entozoa or lumbricoides are also occasionally met with in the appendix, which, inducing inflammation, lead to various disordered conditions. Thus, Ashby²¹ reports a pyæmic abscess of the liver as secondary to ulceration of the appendix resulting from the impaction of a pin.

Joffroy²² reports the perforation of the appendix by

¹⁹ Dr. T. G. Morton has reported by Deputy Surg.-Gen. Marston.

²⁰ MS. of Dr. Guy Hinsdale, Curator, of an analyses of a concretion from the Mutter Museum, made by Dr. Henry W. Cattell, Assistant Demonstrator of Chemistry, University of Pennsylvania. The nucleus was hardened fæces.

(*b*) Analyzed by Prof. Henry Leffman, M.D., of Pennsylvania Polyclinic, Philadelphia.

²¹ London Lancet, vol. ii, 649, 1879.

²² Bulletin Société d'Anatomie, 44, p. 512, 1869.

a pin, symptoms of typhoid fever, peritonitis and death.

Audouard,²³ a perforation of the appendix, perinephritic abscess of the right side and consecutive empyema after perforation of the diaphragm by the pus.

Becquerel²⁴ mentions the issue of lumbricoides into the cavity of the peritoneum through a perforation of the appendix.

Mestivier²⁵ speaks of a tumor near the right side of the umbilicus occasioned by a large pin found in the appendix.

William Pearson, Jr.,²⁶ reports ulceration of the appendix; portal phlebitis and multiple abscesses of the liver.

Freeman,²⁷ an abscess of the appendix followed by phlebitis of the left leg.

Bontecou²⁸ relates three cases of abscess and pelvic peritonitis from perforation of the appendix.

Claiborne,²⁹ an abscess of the appendix opening externally.

Thornton,³⁰ ulceration of the appendix and fatal peritonitis, produced by an orange seed (?) or what was supposed to be such.

Mason reports perityphlitis with perforation of the appendix; rupture of the wall of the abscess, causing general peritonitis and death seventy-four days after the abscess had been freely opened. These are but a few of the well recorded cases of the results of appendicitis.

For these and previous references I am indebted to the *Index Medicus*.

²³ Progrès Médical, vol. iv, p. 416, 1876.

²⁴ Bulletin Société d'Anatomie, vol. xvi, p. 169. Paris, 1841-42.

²⁵ Journal de Médecine et Chirurgie et Pharmacie, vol. x, p. 441. Paris, 1759.

²⁶ Transactions of the Medical Society of New Jersey, 1879, p. 279, 1881. Newark, N. J.

²⁷ Canada Lancet, vol. iv, p. 268. Toronto, Can.

²⁸ Trans. Med. Soc. of New York, vol. lxvii, pp. 137-139. Albany, 1873.

²⁹ Claiborne. American Weekly, Louisville, vol. 1, p. 53.

³⁰ American Medical Weekly. Louisville, 1874, vol. 1, p. 305.

The glands of Peyer in the appendix may become the seat of tuberculous deposit, softening, ulceration and perforation, as is sometimes seen in phthisis pulmonalis, or there may be a perforation of the appendix from softening and ulceration of Peyer's glands in typhoid fever. Great changes in the walls of the appendix sometimes result from appendicitis. When ulceration supervenes, the walls and the canal may become contracted and indurated, the appendix being so shortened as to be only 1 or 2 inches long, giving the operator the impression of its being a gland or neoplasm; but a careful examination with a probe will usually detect the canal of the appendix.

The stenosis of the canal of the appendix, leading to a retention of its secretion, not infrequently results in the formation of a calculus, as before stated, the nucleus of which may be a speck of hardened fæces around which the mucus collects, receiving in addition a deposit of phosphate or carbonate of lime. As the liquid is absorbed, the layers of the calculus become denser and it is moulded to the shape of the canal, impacted, and often firmly held in place. Sometimes several calculi, from the size of a raspberry seed to that of a date or olive stone, for which they may be readily mistaken, are also seen.

Whilst writing this, I received from Deputy Surgeon-General Marston, of London, his report to the British War Office of the meeting of the Ninth International Medical Congress. In this I find his opinion corresponds with my own. Writing of appendicitis and ulceration he says:³¹ "These are often described in the text-books as due to the introduction of foreign bodies into the canal, but in my experience, while such may be present, they are not always so. Apart from tuberculous affections of the glandular structures of this part of the bowels, all the cases I have

³¹ Report on the Ninth International Medical Congress, by Deputy Surgeon-General Marston, representing the War Department. London, p. 42.

seen have been of a similar character. The canal contains a substance in shape and form like a date stone, fairly dense, but capable of being cut or indented by the finger-nail; of a brownish or yellowish brown color, formed apparently as follows: An insignificant fragment of fæcal matter finds its way into the canal of the appendix vermiformis; catarrhal inflammation follows, with a fluid secretion holding phosphate in solution as a product of the inflammation. The fluid being absorbed, the phosphate forms a soft concretion, which becomes moulded to the shape of the appendix and in turn sets up inflammation, ulceration or sloughing of the coats of that part of the intestine."

SYMPTOMS OF APPENDICITIS.

The symptoms of appendicitis are, in the commencement, such as indicate disorder of digestion, the disease appearing sometimes without premonitory symptoms and resembling a certain type of colic, with vomiting and griping pains, that at intervals attain great severity and double the patient up, to relax the abdominal muscles. Sometimes the right thigh is flexed on the pelvis to relax the iliacus internus and psoas muscles. The pain may be preceded or followed by vomiting, first bilious and subsequently stercoraceous. Often there is pain towards the navel and a sense of constriction of the belly as in hernia, with continued constipation, or one or two movements of the bowels and then constipation. These symptoms, under the ordinary treatment of colic, may pass off and not return for several weeks; but after an uncertain period of weeks or months, the griping and vomiting return with more violence, though sometimes the attack is violent from the commencement, with evidence of disorder in the right iliac or lumbar region, the patient ignoring previous attacks and misleading his physician, unless closely questioned. When the symptoms are severe and

last for twenty-four or forty-eight hours, with tenderness and evidence of local peritonitis, fever is apt to follow; the pulse counting 90 or more and the temperature reaching 102° or more, with indication of localized pain. Free urination also is often a marked symptom. The belly sometimes becomes tympanitic and percussion may indicate a degree of flatness in the right side or towards the umbilicus; but flatness is not always noted, owing to gas in the colon. Sometimes, under the relaxation of ether, it is possible to recognize by palpation a spot that is doughy or more resisting than natural. Sometimes it is more prominent than usual, and sometimes it is possible by relaxing the abdominal walls to circumscribe a swelling or tumor that is sensitive to the touch and corresponds with the position of the cæcum, but often there is only a thickening of tissue and no defined tumor. As gas cannot escape from the bowels, tympanitis becomes more marked, fever increases, with pain, and symptoms suggestive of perforation of the bowels and acute peritonitis appear; but frequently we note only a slight acceleration of the pulse during the colicky pain and are liable to be misled by the temporary relief of pain and the absence of swelling or fluctuation.

DIAGNOSIS OF APPENDICITIS.

One of the marked difficulties met with in the treatment of appendicitis is a correct diagnosis, and this difficulty is so great that Mr. John Hunter said it never could be satisfactorily made during life.³² This difficulty is often increased by the fact that the case is sometimes under the care of the family physician who only calls for the surgeon's assistance at the last moment. When seen early, appendicitis may be suspected from the previous history, especially a continued tendency to constipation and the repetition at

³² Eberle's Practice.

varying intervals of colic or vomiting. When a suspicion exists of the presence of obstruction in the appendix a correct diagnosis can only be arrived at by exclusion. Thus, are the symptoms presented due to hernia, to volvulus, an intussusception, a tumor of the mesentery, or other organs. Comparison of the symptoms of each of these with the history of the case will greatly aid the diagnosis. Then, the patient being etherized, let careful palpation be practiced of the right iliac, hypogastric and even lumbar regions. Sometimes a cæcum can be recognized as impacted, sometimes a doughy or imperfectly indurated structure can be felt in the right iliac or lumbar region; at other times there will be severe acute pains in these regions. When any of these symptoms are recognized, when the pulse and temperature permanently rises and there are the symptoms of peritonitis, the diagnosis may be regarded as sufficiently correct to justify surgical interference. If laparotomy is performed and the diagnosis of pus, perforation, or thickening of the appendix is not found, the result will be often more favorable than the subsequent changes induced by appendicitis left to nature. The use of an exploring needle is liable to serious objections and dangers and is not a useful addition to our means of diagnosis.

PROGNOSIS.

The prognosis of appendicitis is always grave, and the result uncertain, the patient's condition resembling that of one with a reducible hernia, liable at any moment to be strangulated. Sometimes under early and appropriate treatment the symptoms of appendicitis disappear, the disease terminating apparently in resolution and in the restoration of the peristaltic action of the cæcum; but in other instances, where there is hesitation in diagnosis and delay in treatment, the disease running on to a perityphlitic

³³ Report of 9th Congress, by Marston, 1888, p. 43.

abscess, perforation of the appendix, artificial anus, or death from peritonitis may be anticipated. The prognosis is always largely influenced by the duration of the symptoms, especially when local peritonitis is being developed. Laparotomy under such circumstances offers the only chance for a successful termination, for as Marston has said,³³ "there seems no reason to doubt that by a timely operation such cases might be saved."

TREATMENT OF APPENDICITIS.

As the details of laparotomy and its after treatment are to be presented by Dr. Morton and others who will follow, I will only urge upon the Section the importance of an early recognition of appendicitis and the carrying out of a preliminary treatment adapted to intestinal catarrh; such as the administration of 5 grain doses of calomel until 20 or 30 grains are taken, this being often readily retained by the stomach even when it rejects liquids; the free use of stimulating enemata containing soap and turpentine; the administration of hypodermic doses of morphia to relieve the griping, and the administration as soon as the stomach can retain it, of a dose of sulphate of soda or magnesia, the first being preferable. I am aware of the arguments against the use of purgatives in general peritonitis; but I am now speaking of the early stages of appendicitis, with probable stenosis of the canal, and before perforation occurs. In this stage, saline purgatives relieve congested vessels, increase the serous discharges, empty the cæcum, and favor the escape of the secretion of the appendix. An important part of the early treatment of appendicitis is, to etherize the patient and by judicious palpation or taxis, endeavor to recognize the obstruction and favor peristaltic action. This palpation should be exercised with the same caution as would attend the attempt to reduce a strangulated hernia. After persevering for 48 hours with this

treatment, if relief is not obtained, I would at once resort to laparotomy under strict antiseptic precautions.

The line of incision in laparotomy for perforating appendicitis will be hereafter stated by Dr. Morton. The incision in the median line, known as the Cæsaræan section, is the ancient one, a successful operation in a so-called case of ileus being reported by Dr. Fuschtius in *Hufeland's Journal* of Feb. 7, 1826.³⁴ Whatever incision is selected should be prolonged until the appendix is found. Let the surgeon *first look for and examine the appendix for calculus or perforation*, and the subsequent steps of the operation can be decided by circumstances. Generally it is safer to ligate the appendix and cut it off close to the cæcum, and I am satisfied that an early laparotomy offers less risk to life than a temporizing course, that is liable to end in suppuration of the connective tissue of the vascular structure of the cæcum and the development of a general peritonitis. The simple evacuation of the abscess without amputation of the appendix does not secure the patient against a return of the trouble, as was proved in a patient shown me by Dr. Morton, and will be reported by him.

SUMMARY.

The following summary is presented for the discussion of this subject:

1. Appendicitis is characterized by constipation, vomiting, griping pain, and other symptoms of disturbed digestion.
2. Appendicitis very frequently creates the pathological conditions that result in concretions, ulceration, perityphlitis, or pericæcal abscess.
3. When a diagnosis is made and a preliminary treatment of an intestinal catarrh fails to arrest appendicitis, laparotomy should be promptly performed.
4. A delay in operating in appendicitis, as in stran-

³⁴ Eberle's Practice of Medicine.

gulated hernia, increases the danger of a fatal termination.

APPENDIX.

The following translation from Herlin's paper, as alluded to in the first part of this paper, was made and forwarded me by A. Asst. Surgeon, D. S. Lamb, U. S. Army, but arrived too late to be incorporated in the text. As it exhibits the opinion of an anatomist on the "function of the appendix vermiformis" in 1768, it is now offered for the consideration of the reader.

Philadelphia, May 12, 1888.

REFLECTIONS AND OBSERVATIONS ON THE USE OF
THE VERMIFORM APPENDIX OF THE CÆCUM.

By M. Herlin, Demonstrator of Anatomy at the Port of Brest. From Journ. de Méd. Chir., etc., July, 1768, page 321.

Anatomists have devoted themselves through all time, to determining the use of the parts which they described, and demonstrating their mechanism. Although they have satisfied us, as to an infinity of interesting objects by which medicine has profited, it is necessary to admit that they have not yet discovered all, and that there are some parts the use of which is but little known. Since all that has been said upon the use of the appendix of the cæcum does not explain the changes and variations to which this part is subject, and is hardly in accord with the arrangement or the function of organs to which this body appears to be destined, might we not advance what has not been guessed heretofore, viz., to determine the true destination of it. Supported by observation, I shall try to do it, although the result may appear to have but little interest; but it is important always to know what it is, if only to satisfy our curiosity.

Of all the opinions that have been proposed as to

the *use* of the appendix of the cæcum, it is only that which assigns to it the property of being the reservoir of a mucous humor, flowing continually into the cæcum to lubricate this intestine, and protect it from the acrimony of matters lodged there, which has some truth in it, and which merits attention; but this is very far from filling the idea one ought to have of the utility of this part, as I will soon show. To say with some anatomists, that the appendix of the cæcum is not larger in the foetus than in the adult, (caused by the distension the part experiences from the presence of mucus retained in its cavity by the presence of the meconium) is to hazard an opinion that the inspection of the part contradicts; since we do not find it more sensibly charged with this mucous in early life than in the adult, and one observes on the contrary, that this little intestine is smaller in persons, in proportion, as they are more or less constipated and subject to stercoral colics. Another object on which anatomists have passed, and which demands attention, is that the cul-de-sac of the cæcum is scarcely marked in the foetus, but increases more or less with age, and about in proportion as the appendix in developing loses in length; without doubt, because the change is made so insensibly during the whole course of life. The opening of the bodies of some sailors who died of a kind of colic called dry colic, opened my eyes on this subject. I found the appendix of the cæcum in two of the subjects almost entirely effaced; the cæcum and colon enormously dilated and filled with a quantity of hard matter and much rarefied air. The coats of the colon were very thin; its sacs had disappeared, and its ligamentous bands were scarcely visible; while those of the cæcum, continuous with it, and the coats of the cul-de-sac, appeared to have lost very little of their ordinary thickness.

I see then in this, not only the explanation of the phenomena that the cæcum and its appendix

have presented to me in the state of disease, but the reason of all the variations naturally seen in the disposition of this organ, which determines more exactly its use.

In order to conceive the thing, it is enough to have present in the mind, the disposition of the cæcum and colon. One soon feels that the matters retained in the cæcum cannot pass out into the arch of the colon, because they would be raised considerably against their own weight, and the power to act on them can have the effect only of pressing them laterally; whence it ought to result that the tendency of the matter would be, that part of the effort would necessarily be lost in the fundus of the cæcum; here we find a point of support that reacts upon them with more advantage as the cæcum is fixed and retained by its ligaments, and it cannot escape the force which is applied perpendicularly by the sterocoral column upon its fundus. This function, continuous and necessary to nature, and which tends without ceasing to dilate and elongate the fundus of the cæcum, would soon thin and burst it if nature had not taken precaution against such accidents by a mechanism as simple as admirable, in sustaining the fundus of this intestine, so that the three ligamentous muscular bands, which contract the colon, form with it the appendix, and present a part which is insensibly developed, and foreshadows (in furnishing the augmentation of the cæcum) the thinning of the coats, and perhaps in certain cases, the rupture of this intestine, preserving always by this arrangement, of the three bands placed along the length of the colon, an equal and durable force, which would not have been the case if they had been placed transversely and sustained the fundus. It is also to preserve this function, and to render it solid and durable, that nature has thrown a little on one side, the narrowing of the cæcum; the weight of matters thus acts less directly on this part, and development is a

little more difficult, and with a slowness which is an advantage. It is quite true that in the appendix there is filtered a mucus; and therefore we should regard it as one of the uses of this part, to furnish a matter capable of lubricating the cæcum, but which, at the same time, is capable of opposing efficiently the extension of the walls of this little intestine which we may regard as a corner stone.

The contraction and the folds of this part, which are larger as the appendix is elevated, and more favorable to turn out the liquor which is filtered into the cæcum, are intended to prevent the too rapid flow of the mucus, the presence of which in the appendix is necessary to the preservation of its state.

From all these economic views of the use of the appendix vermiformis, it is easy to deduce all the natural or accidental varieties that this part may present in different subjects and all ages. Why, for example, when the appendix corresponds to the fundus of the cæcum, we find it larger and less shrunken? Why, as age increases, this part is found shorter than in subjects where the appendix is placed on the side, and as in this last case, when the appendix is much narrowed and very long, we find in the progress of age the cæcum capacious and its walls very thin. We explain also easily, why women who have had children, have the appendix short, and the cul-de-sac of the cæcum very long; in a word, there are no phenomena which I have mentioned above, which may not be ascribed to this explanation, and confirm at the same time, the use which I believe should be assigned to the vermiform appendix.

THE DIAGNOSIS OF PERICÆCAL ABSCESS, AND ITS RADICAL TREATMENT BY REMOVAL OF THE APPENDIX VERMIFORMIS.

Abdominal surgery can show many brilliant achievements under modern antiseptic methods, but in scarcely another instance does an operation so completely afford its own justification, or when properly timed present such satisfactory results, as laparotomy when performed for suppurative appendicitis.

PATHOLOGY AND CLINICAL HISTORY.

It will greatly simplify the subject under discussion if we can first clear up the nomenclature, which, it would seem, has been more or less confused by the refinements of pathologists and others. We are accustomed to certain distinct terms to express inflammation of the cæcum, of its peritoneal investment, and of the surrounding structures and cellular tissue.

It would seem reasonable that all the niceties of diagnosis between typhlitis, perityphlitis, paratyphlitis and pericæcal abscess can properly be set aside, as without real practical value; since recent pathological researches have demonstrated that, as a rule, in cases presenting the well recognized characters of typhlitis, the symptoms are almost invariably due to appendicitis. Exceedingly rare are the cases where the cause resides in the cæcum. Fitz records but three cases in which pericæcal abscess was caused by ulcerative perforation of the walls of the cæcum; and in each instance it was due to the presence of a foreign body. Pericæcal disease may, then, in most cases, be said to mean disease of the appendix vermiformis.

It seems hardly worth while to consider the conventional division of appendicitis into the catarrhal and ulcerative; for, clinically speaking, although an uncomplicated catarrhal condition may exist, there are no signs by which it can ordinarily be recognized.

Inflammation and perforation of the appendix in most cases, very probably in all cases, is due to irritation excited by the presence of a foreign body in the organ. It has been shown that the foreign substance is commonly a fæcal or phosphatic concretion, or an aggregation of small objects which from time to time have gained an entrance; or the concretion may be composed of epithelial or other constituents aggregated into a hard mass from the ordinary secretions of the parts.

No complete or fully satisfactory classification of the cases of inflammation, perforation and abscess of the appendix can probably at this time be made; but for practical purposes, a division according to the onset and history of the disease, into the acute and chronic varieties, will probably fulfil all necessary clinical requirements.

In the acute disease, the symptoms come on with suddenness and increase in severity, and often very early present the gravest characters. Occasionally the disease progresses from first to last with frightful rapidity, so much so that the patient quickly enters a condition bordering on collapse. In one case which recently came under my notice, the child perished with perforation and purulent peritonitis forty-eight hours after the first symptoms were observed.

Possibly such extremely acute cases as the one mentioned might afford an opportunity for still further division into the ordinary acute and the supra-acute, the latter running their course in a very short time, often in a few hours. An explanation of these forms will be given later, when considering the pathology of the subject.

Recently I saw in consultation a case which pre-

sented marked symptoms of perforative appendicitis. After the pus cavity was opened the patient became so profoundly exhausted that death seemed imminent and all further exploration had to be abandoned. Surgical interference in many cases is unfortunately so long postponed that a favorable result can hardly be expected.

The close proximity to the peritoneum of such fetid pus as is found in suppurative appendicitis produces very early unusual depression and exhaustion; so much so that occasionally anæsthesia and simple incision is sufficient quickly to give rise to symptoms indicating heart failure. In such cases any further exploration of the abscess cavity is impossible.

In the chronic forms of appendicitis, we have recurring attacks or relapses. Such repeated attacks of inflammation about the appendix region are often followed by a deposit of lymph which forms a barrier more or less complete, sufficient, when perforation takes place, to protect the peritoneal cavity at least for a time. But if operative measures are not undertaken or are unduly delayed, such lymph partitions often yield, and the general peritoneal cavity becomes involved and peritonitis results.

In other cases the abscess walls form a distinct pus cavity which surrounds the organ, so that when perforation occurs, the contents of the abscess form a tumor, or more or less defined hardness. Such tumors frequently make their way toward the surface, and the superimposed structures become infiltrated and markedly œdematous. In such cases the perforation of the appendix may remain open and a fistula form between the bowel, the abscess cavity and the external abdominal surface.

In January, 1885, I saw a case of this character in consultation, in a lad 11 years of age, who had all the symptoms of perforation and abscess of the appendix. A tumor gradually developed and perforated the abdominal walls. Subsequently I made a free

incision and evacuated a large amount of pus. The general condition of the patient at the time did not warrant a search for the appendix. The fistula never closed; the boy two years later perished from pulmonary tuberculosis. In any abscess of the ileo-cæcal region, we should always suspect appendix disease, and an effort should always be made to expose this organ. In no case should a simple evacuation of pus be considered sufficient, especially if the history of the case presented any account of former appendix trouble. A case of this character came under my care some two years ago, in which I simply evacuated an abscess situated in the ileo-cæcal region, and made no investigation of the appendix, as the abscess cavity seemed a closed one. Two years later I was obliged to make abdominal section and removed a diseased appendix, which undoubtedly existed at the time of the first operation.

L. A. B., a stout girl of healthy parentage, and with no family history of cæcal or appendicular disease, had a severe fall upon the buttocks in March, 1884. She was almost immediately seized with a terrible attack of vomiting and retching, which lasted hours. From this time until September, 1885, she suffered with extremely painful menstrual epochs, and from time to time, when tired, had a recurrence of vomiting similar to that immediately succeeding her fall. On September 10, during the progress of one of these vomiting spells, she experienced severe pains in the right cæcal region, the whole seizure lasting about ten days. Another attack developed on September 29, and still others on November 10 and 23. The latter was brought on by taking cold, and in five hours she was compelled to go to bed, and endured the most excruciating drawing pains, which radiated from the right cæcal region to the shoulder blade of the same side. Vomiting continued for some hours. Emesis then ceased, but the pains continued off and on until January 10, 1886, when I first saw the pa-

tient. A hardening was then present in the right ileo-cæcal region. Poultices and mercurial inunctions were ordered, which gave very marked relief. She daily seemed to improve, and before March 19 had resumed her household duties. On that date she was much overworked in caring for company, and about midnight was seized with torturing pains in the region of the hardening. These continued until April 3, when I incised the now greatly enlarged mass, liberated a large quantity of fetid pus, and introduced a drain tube. There was apparently no communication with the cæcum or its appendix. The tube remained in for a long time, and the wound did not completely close until August. Her condition, however, had meanwhile improved amazingly, and she was soon quite herself again, being up and about the house in four weeks.

After this, especially when tired out or at a menstrual period, the patient suffered with pain localized about the cæcal region. The attacks resembled colic. Three months after operation she had quite a severe attack of local pain which lasted a number of hours. These attacks, at long intervals, presented about the same characteristics. The last occurred in January, 1888, which was accompanied by more severe pain than any of the others.

During the evening of Friday, March 15, she was taken with violent vomiting and purging. These symptoms continued all night, and through Saturday when the pain was most intense. On Sunday her symptoms appeared grave. Pain was increased on pressure in the right ileo-cæcal region. Abdomen soft, fever, rapid pulse and dry tongue. On Monday the symptoms continued the same, with a temperature of 102°. In the afternoon the general symptoms were more serious. No tumor could be felt, only increased pain. Skin was bathed with sweat. There was marked resonance over the part. On Tuesday the pulse was feeble, nausea and occasional sick

stomach prevailed. The other symptoms remained about the same, when diagnosis of perforated appendix with abscess was made. The same morning she was etherized, and the usual lateral incision 5 inches long was made, which came about an inch further laterally than the line of incision of the first operation. The deep tissues of the abdominal wall were somewhat oedematous, and just before the peritoneum was reached, a large quantity of most fetid pus was liberated. At the base of this cavity was clearly visible the cæcum and appendix. The latter was enormously enlarged, thickly covered with lymph and abscess lining membrane. A considerable-sized opening also communicated with the cavity of the general peritoneum, through which small intestines were forced when she coughed.

The appendix was firmly attached to the cæcum, from which it was separated with some difficulty. It was then firmly ligated with stout silk at its junction with the cæcum and excised. The communication with the general peritoneum was then dilated, and through it the intestines were most thoroughly washed by means of hot water irrigations. The abscess cavity proper and surrounding parts were sponged with 1:1,000 mercuric solution. A glass drain tube was then carried to the bottom of the pelvis and brought out through the lower angle of the wound, while a larger rubber tube occupied the line of the same and emerged at its upper extremity.

The incision was then closed and an antiseptic dressing applied. She reacted and continued to do well. Immense swelling of the wound occurred on the following day and necessitated the cutting of all the stitches, whereupon the cæcum lay in full view at the bottom of the wound, but no prolapse of intestine at any time took place.

Great sloughs kept coming away for many days, also much pus, in spite of every effort to keep the wound aseptic. The deep glass or pelvic drain be-

came dry on the fourth day and was removed on the fifth. From that time the wound was kept lightly packed with antiseptic material and rapidly granulated to the surface, when a few strips of rubber plaster were applied.

Patient's bowels, from time of operation, were kept in a freely moving condition by means of citrate of magnesia and enemata. In less than a month the patient was well, and has since been married. The appendix was found to be the seat of a very large perforating ulcer, situated near its cæcal attachment, but no foreign body was discovered.

The following case I saw in consultation with and operated upon for Dr. Ed. R. Stone, of Philadelphia:

Mrs. G., æt. 34, mother of one child, had been perfectly healthy up to time of last illness, save for occasional attacks of colic which had readily yielded to anodynes, and it was said that she had had a severe attack of pain and vomiting some months before. For two days previous to February 18, 1887, she severely exerted herself and menses were overdue. On that day she had severe abdominal pain accompanied by vomiting. The pain was described as starting in the right hypochondriac region and darting to the umbilicus. No tumor was perceptible, neither was there tenderness upon pressure. Anodynes and counter-irritation were ordered. February 19, pain less, no emesis nor rise of temperature; some soreness and tenderness to the right of the umbilicus. Pain returns as anodyne effects pass off. Bowels have not moved for several days. Abdomen somewhat tympanitic, tongue coated and hard at tip. Evening temperature 100°; pulse 90. Treatment continued.

February 20. Restless night. Vomits yellow material freely. Abdomen tympanitic and tender. T. 101°; pulse 110. Operation advised, but refused.

February 21. Symptoms continue. She is quieter but weaker. Abdomen very large and tender. On

the morning of this day I saw her and, although her condition was very unfavorable, urged abdominal section as her only chance for life, as my diagnosis was perforated appendix and subsequent peritonitis.

A free incision was made laterally over the cæcal region, and the appendix found greatly enlarged and perforated in two places, both holes measuring a little more than $\frac{1}{4}$ -inch in diameter. A silk ligature was placed upon the appendix close to the cæcum, and the offending organ then removed. There was also purulent peritonitis. The abdominal cavity was thoroughly irrigated, the region of abscess cleansed and a drain inserted. She died in a few hours.

The following case presents the prominent symptoms which are usually observed in cases of chronic suppurative appendicitis; and this patient has been benefited as much by the practical application of the principles of modern wound treatment as any human creature ever can be. He was a patient of Dr. Frank Woodbury, with whom I saw him in consultation and who conducted the after-treatment.

Charles K., æt. 26 years, had enjoyed good health until three years ago. Since that time he had been subject to frequently recurring attacks of abdominal pain, which would come on without warning whilst he was apparently well, and completely prostrate him. The pain was of a stabbing character and most severe about the lower abdomen and umbilicus, and was attended with great tenesmus of rectum and irritability of bladder. These attacks, after lasting a few hours, would usually pass off, leaving him in a weak condition. During the periods between attacks he kept very well. The last seizure began about April 20 last (1887), when he consulted Dr. Woodbury. He was then haggard, sallow, and constipated; the tongue was heavily coated. Abdominal pain was much complained of. Urine contained much albumen and few casts. He was placed upon usual medicinal treatment, but steadily grew worse. Two

days later his temperature rose to over 103° , pain became very severe, there was much nausea and vomiting, and a distinct hardening, but no tumor could be felt in the right iliac region of the abdomen. These symptoms continued to augment until I saw him three days later, and determined that operation was his best and only chance. At the time of operation his condition was discouragingly wretched, that of a man in the dying stages of general purulent peritonitis. Nevertheless, operation was begun and carried to successful termination. The patient was stimulated and antiseptically cleansed. The incision was made laterally over the seat of induration. The latter had now become slightly prominent. An abscess cavity was entered at the depth of an inch below the abdominal surface, a free flow of pus took place and the cæcum and its diseased appendix came into view. A phosphatic concretion resembling a cherry stone was found alongside that organ, but entirely outside it, and evidently was the cause of the whole trouble. The vermiform appendix was greatly swollen and exhibited a perforating ulcer three-fourths around its circumference and very near to the point of its cæcal attachment. A silk ligature was applied close to its root and the remainder excised, together with a large portion of omentum which projected into the abscess cavity. The peritoneal cavity was then thoroughly washed out with warm water, for an opening into the general peritoneum was found, and through it the pus had passed into the cavity of the peritoneum. The abscess walls were then thoroughly curetted and, after a final wash, a rubber drain was carried to the bottom of the pelvis and the wound was partly closed. On the following day, drainage being imperfect, every stitch was removed, the wound gaped immensely, sloughs came away, healthy sup-puration was established and granulations appeared, and the wound promptly closed.

Convalescence was uninterrupted from this time;

his temperature never again reached 100° , and he has enjoyed perfect health until the present time. The drain was removed piecemeal; the last portion not until sixteen days after operation.

In the following case the result was less fortunate:

On the 13th of last January, I was called in consultation to visit a child 9 years of age. It seemed that she had suffered from backache, and frequent attacks of pain in the abdomen. She attended school until just before Christmas, she then had a severe colicky attack, but subsequent to this was apparently quite well, and on December 31, was on her sled for several hours. On January 6th she was seized with sick stomach, abdominal pain, and had high fever; after this she was so much better that she was down stairs, and ate of sausage and rolls; soon after she was seized with violent abdominal cramps, the right iliac region being exceedingly painful. January 12, she had an attack of pain which was most excruciating in character. The following day when I first saw her, the condition was wretched, almost a collapse; but not to such an extent as to justify denial of her only chance of life, as I had diagnosed peritonitis originating in a perforated appendix and advised operation. Upon making a lateral incision, as soon as the peritoneum was opened a great flow of putrid pus took place, then the cæcum and appendix came into view; the latter was greatly swollen, and the cæcum and appendix were covered with greenish-yellow pyogenic membrane and lymph. The end of the appendix had sloughed off, and was gangrenous for some distance; one foreign body was found in the abscess cavity, another was partly held in the sloughing end of the organ, and two other concretions were in the canal near the cæcum. The appendix was ligated at its base and exsected; the whole abdominal cavity and its intestinal contents which were in a state of purulent inflammation were thoroughly inundated with hot

water; a tube was carried into the pelvis, and the wound was closed and dressed in the usual manner; the child never reacted fully, but died seven hours afterwards.

We may provisionally classify these cases of appendicular disease according to the pathological conditions which each case illustrates:

First, those cases where the appendix and its surroundings become encysted by deposit of lymph, so that a cavity more or less complete is formed, into which the contents of the appendix are received when perforation occurs, while the walls of the cavity afford possibly, a complete partition which separates it from the peritoneal cavity. These cases are likely to be chronic in their course.

Secondly, those cases where an insufficient limiting lymph partition wall has been formed, and where the general peritoneum promptly becomes involved. Thirdly, where appendicular ulceration and perforation has been so rapid that sufficient lymph for the production of a partition wall has not been thrown out. This group furnishes the acute cases.

SYMPTOMS.

The earliest symptoms of appendix inflammation or irritation are commonly pain in or about the caecal region, which is often paroxysmal in character. The pain is increased by pressure. There is nausea and vomiting. Constipation is commonly present. The urine is frequently scanty, or it may be nearly suppressed.

These symptoms may sooner or later disappear with apparently full convalescence. A relapse or recurrence of symptoms demonstrates that an irritation still remains. The attacks recur at variable periods, and perhaps with graver symptoms, or during any such attack the sudden advent of violent local and constitutional symptoms definitely announces the occurrence of perforation of the appendix.

If perforation occurs after many such recurring attacks, the pericæcal inflammation has usually been sufficient to secure a protecting medium between the diseased tissues and the general peritoneum; and when perforation occurs, there is less danger of peritoneal involvement. As suppuration increases, a tumor is formed, which may work its way forward to the surface in its course gradually infiltrating the abdominal muscles and dissecting the tissues before it. At this period there is usually considerable œdema, and as the abscess approaches the surface, the skin becomes red and discolored. Occasionally, however, the pus does not take such a favorable course, but may point in the bladder, bowel, hip-joint or other unusual position. The presence of pus close to the peritoneum is always attended by very marked, sometimes profound depression of the vital powers. The patient experiences chilly sensations, if not actual rigors. The temperature is elevated. At the same time there is more or less general sweating. Later on, a fullness may be felt about the ileo-cæcal region; but until a circumscribed pus tumor has formed, the ileo-cæcal region continues to be resonant, indeed, it is often unusually tympanitic, so that before the pus tumor can be felt, the presence of suppuration in this locality must be determined by the history of the case, and the same general rules by which pus is recognized in other localities.

It is probable that in many instances, attacks of colic, so-called, are simply contractions of the appendix incident to nature's efforts to expel foreign bodies from this organ. To show how common it is for the appendix to harbor foreign bodies, I may state that in thirteen consecutive post-mortems made recently at the Pennsylvania Hospital, in persons who had died from other than intestinal disease, the appendix in every instance but one contained fæcal concretions. In a number the foreign bodies were quite soft; others were firm, while others were gritty

in character. In several cases, the appendix was blocked up by foreign bodies for an inch or more. No doubt such material may become imprisoned, and if not dislodged and thrown into the intestine, may excite appendicitis, ulceration and perforation. Indeed, that such is the usual history, is now well recognized.

Actual perforation of the appendix is generally ushered in by intense excruciating, agonizing pain, which is somewhat relieved by the occurrence of the accident.

Twice I have known instances where two children in the same family perished from perforation of the appendix; this experience may simply be a coincidence, but it would seem possible that stenosis of the outlet of this organ may prove to be occasionally a hereditary condition.

TREATMENT.

For practical purposes, the treatment of pericæcal inflammation must be divided into two subdivisions; that of the pre-purulent and that of the post purulent or suppurative stage; or first, before the formation of pus, or of appendix perforation, and second after that event.

The treatment of the pre-purulent, irritative or simply inflammatory disorders of the cæcum and its surroundings, should consist of rest in bed, restriction of diet to nourishing liquids, hot poultices or fomentations frequently replaced upon the parts, perhaps local depletion, and the hypodermic exhibition of morphia to control pain. The bowels should be kept open and free from the accumulation of gas or fæces by the administration of saline laxatives and enemas; perhaps with the addition of turpentine to the latter.

Pain of intense character, would often be as much an indication for operative relief as for morphia.

Prompt resolution should take place in cases which

are not to go on to the stage of pus formation, and very long continuation of symptoms or relapses or recurrences would be strong indications for surgical interference.

The presence of such tedious recovery, relapse or recurrence, would point to the probable presence of conditions exceedingly dangerous to the patient, from liability to general peritonitis or perforation at any time. They would further point, as a rule, to the appendix as the source of irritation and danger; indeed, in man, that worse than useless appendage must be regarded as the root of most evil in the region under consideration.

Where the process has reached the suppurative stage, and this condition has been recognized, the course to be pursued is, indeed, very plain. Even a small amount of pus lying near the peritoneum is vastly more of a risk than an abdominal section performed for its removal. Hence, I should operate whenever the diagnosis of pus has been made, occasionally even without positive diagnosis—indeed, without qualification, I repeat, that pus being present in the region of the cæcum, operation is positively indicated.

Many other risks are to be taken rather than those of purulent peritonitis, for early interference will save most, if not nearly all, cases from this latter dread complication; while the danger of operation becomes slight compared to that of rampant abdominal inflammation.

Local or general peritonitis supervening in a person who has a history of cæcal trouble or starting during a first attack would more than justify operation.

At a later stage of the disorder, all available diagnostic skill must be exerted to detect a pericæcal abscess, should it point in an anomalous situation. We must ever, however, bear in mind the surgical rule always to attack pus at its source if possible.

When the cæcum is normally placed, this is always feasible if the disease be recognized.

THE OPERATION.

On account of the nature of the case, there is little time for special preparatory treatment for the operation. The surroundings of the patient should correspond with the usual requirement for abdominal operations. Asepsis should be rigidly observed in every particular.

The aspirating or exploring needle should never be used for diagnostic purposes; for if it does not find pus, we cannot be sure that none is present, while its own dangers are not inconsiderable. In these cases it is a dangerous and especially unsafe diagnostic resource.

Having the patient supine and extended, the field of operation is to be thoroughly cleansed, shaved, and washed with a bi-chloride solution 1:1000 and finally with ether. Towels wrung out of the mercuric solution are placed to protect the field of operation.

The line of abdominal incision should be slightly oblique or vertical, not median but lateral.

The advantages of the lateral incision are very obvious and positive. If median, the peritoneal cavity would often be opened needlessly, and at a point far remote from the cæcum and appendix, and in a position in which the cæcum and appendix cannot well be reached or dealt with. The lateral incision can be made of less size and directly over the appendix and abscess cavity. Moreover, in this situation, small circumscribed or secondary abscesses in the abdominal wall, which are sometimes come upon, can be evacuated before the peritoneum is reached, and at its base all necessary manipulations can be made in many cases without opening the general peritoneal cavity at all; while, should the suppuration have extended in this direction, the intestines can

just as well be examined and cleansed through a lateral as through a median incision. Should there be subsequent sloughing of tissue, as frequently occurs, the sloughs can be far more readily discharged through an opening immediately over the locality of the disease than if it were situated elsewhere; while drainage can be much more thoroughly accomplished by a lateral incision. The length of the incision depends upon the conditions found after the abscess cavity is reached: an incision three or four inches in length will often be sufficient for the removal of the appendix; but in case there is a large abscess cavity it can be increased to any desired extent.

The favored or lateral incision should be begun at a point about an inch above the middle of Poupart's ligament and to the outer side of the right linea semilunaris, to be continued from this point upwards in a vertical direction, or outward and upward, and carried down until pus, cæcum or peritoneum shall be reached. From numerous dissections, made with a view to determine the ordinary position of the appendix vermiformis, I have found that this organ is normally placed immediately under a point two inches distant from the right anterior superior iliac spinous process, on a horizontal line drawn from this process towards the median line of the body.

When the abscess cavity is reached, gas is usually first discharged. The wound can then be enlarged if necessary, in order to fully expose the cavity underneath. Irrigation with boiled water at a temperature of 105° or 110° , and careful sponging, now permits a clear view to be had of the surroundings of the cæcum, and its appendix. The latter is usually found to be the seat of trouble. It would be well to excise it in any case, whilst we have the chance; for any cæcal trouble would be likely, in time, to excite disorder in its appendage. Without a doubt it should be so treated, if found inflamed, perforated or

harboring foreign bodies. This can best be accomplished by ligating it as close as possible to its cæcal attachment with a strong silk thread, and then cutting it off beyond the ligature. Cæcal perforations if found, should be cleaned and curetted, and then closed by Lembert's suture; even ulcers which have not perforated might by the same means be turned into the bowel lumen. If the general peritoneal cavity has not been involved the walls of the abscess should be gently curetted, washed with a mercuric solution 1:1000, and a large drain carried to the bottom of the wound and brought out at its most dependent part. The external wound should, with the exception of a suture or two, be left thoroughly open, and lightly filled with an antiseptic dressing. A rope of absorbent cotton should be placed in the glass tube, a large mass of cotton should cover the abdominal and wound surface. A four tailed flannel bandage completes the dressing.

The question of using Lembert's suture after amputating appendix, as has been suggested, is of no practical importance. The constricted or tied portion which is very close to the cæcum must close by granulation; indeed, the situation is very similar to that existing when Fallopian tubes are ligatured and removed for suppurative salpingitis. No one would think of using a Lembert suture in such a case. Moreover, I have found it impossible to employ such sutures after appendix excision; because the tissues being œdematous, infiltrated and friable, will not permit it. The attempt to approximate them only causes the threads to tear through. Cæcal perforations are different. As already said, the attempt should be made to close such with Lembert's suture if possible; but even here the gut can be lifted up by tenacula and perforation obliterated by a silk ligature.

If the general peritoneum has become involved, the whole abdominal cavity must be thoroughly washed out with hot distilled water, temperature 105°

to 110° F., or bichloride of mercury solution 1:10,000. The intestines should be cleansed with sponges and the foreign body, if that has been the source of the perforation, searched for. Should peritonitis be far advanced, the intestines must be withdrawn and all adhesions parted with a finger or a knife. During the process of cleansing, and before they are returned to the peritoneal cavity, they should be thoroughly protected with towels wrung out of hot water. In all cases of general peritonitis a glass drainage tube must be carried to the bottom of the pelvis and kept in working order by means of ropes of absorbent cotton which act by capillarity. In some cases it may be well to use a second tube of rubber for the more superficial or pericæcal cavity; but if the wound is treated by the open method, this second tube can be dispensed with.

Should the cause of the morbid process be impaction of fæces or a foreign body in the cæcum itself, they must either be excised, or urged by prudent force along the bowel. In their operative removal a simple incision, afterwards brought together by Lembert sutures, would answer every purpose. If portions of the cæcum have sloughed and the breaches of continuity are too large to approximate with Lembert sutures without producing dangerous constriction of the gut we must be content with the formation of an artificial anus. Recent experience in cases of appendix abscess has led me to the above conclusion that the abdominal wound should never be closed, except perhaps in the simplest cases, where no pyogenic membrane exists. Where there is any degree of suppuration, sloughing or pyogenic tissue, the abdominal wound is certainly best treated by the open method. By this I mean that, with the exception of one or two points of suture, or perhaps no sutures at all, the wound is allowed to remain open, so as to favor granulation from the bottom of the cavity, and thus to afford free vent to pus and the results of de-

structive inflammation. Doubtless the cæcum will be exposed, but it will not protrude, and need not lead us to anticipate the slightest difficulty. This portion of the bowel is in a comparatively fixed position and will always afford a barrier to the protrusion of the small intestines. After the wound has granulated to the surface if there is any disposition in it to gape it can be readily approximated and held in position by strips of rubber plaster. The same general principles of treatment will hold even for those rare cases of displacement of the cæcum as into scrotal and other hernia, its abdominal transposition, etc. The important question in these cases will be the diagnosis.

It can properly be said that there is no fixed rule for the time of operation in cases of abscess of the ileo-cæcal region. All I can say in summing up the subject is that when symptoms strongly suggestive of the presence of pus are seen, it is far safer to operate at once than to wait. Procrastination in such cases really means even more than surgical uncertainty. This uncertainty can be set aside only by an exploratory incision. Delay is productive of the gravest consequences to the patient, the prognosis growing worse every hour that the operation is postponed.

AFTER TREATMENT.

Immediately after the operation a hypodermic injection of morphia may be required to relieve pain or check vomiting or restlessness. The ordinary rules of abdominal surgery are observed. The cotton rope should be changed in the tube every few hours. Before it is replaced the tube should be irrigated with a weak carbolic acid or other antiseptic, especially where, as is often the case, the secretions are offensive in character. If the wound is left open there will generally be no need of a second or superficial drainage tube, as the discharges will be at once absorbed into the superimposed dressings. The time

for the removal of the glass drain from the pelvis will depend altogether upon the subsidence and character of the secretion. Frequently the tube is gradually forced out by the action of the intestines themselves and at the proper time. The abscess cavity should be treated exactly as such foul abscess cavities would be treated in any other part of the body. The closure of such a putrefying tract would only add to the danger of the patient without a single compensating advantage.

The bowels should be kept in a soluble condition by salines; threatened peritonitis should be met by active purgation by salines; milk should be given in small doses and at short intervals, and stimulants are generally required. Where there has been much exhaustion and considerable suppuration champagne should be administered *ad libitum*.

Typhoid or tubercular cæcal, or appendicular inflammation or perforation likewise should receive identical treatment as for the simple inflammatory disorders of that region. This whole subject is still in its infancy, so far as the majority of the profession are concerned, but it is of almost boundless promise.

